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(54) CONVEYING APPARATUS

(71) We, MASYC AG, a Swiss body corporate of Pumpwerkstrasse 25, CH-4142 Munchenstein, Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, to be particularly described in and by the following statement:–

This invention relates to conveying apparatus having mutually side-by-side conveyors and having transfer means for transferring an article from one conveyor to the other and *vice versa*.

Transfer conveyors have already been proposed which include conveyor chains which circulate endlessly about pulleys transversely to the conveying direction of at least a first conveyor and beneath the conveying plane thereof and which chains are provided with lifting elements which are situated beneath the conveying plane of the first conveyor in a pass-through position and in a transfer position project simultaneously above said conveying plane at a predefined distance from each other which is less than the width of an article to be transferred.

German Offenlegungsschrift 2 259 273 discloses a system of this kind in which the conveyor chains with lifting elements are guided in the region of the conveyor plane over guide rails on which cam tracks are formed on which the lifting elements are guided upwardly by means of a rising ramp and from which the lifting elements are guided downwardly by means of a falling ramp. Lifting elements situated on opposite sides of a conveyor chain are disposed at a defined distance from each other which is less than the width of an article to be transferred. Each lifting element is associated with its own cam track and the rising and falling ramps of two adjacent cam tracks must be offset relative to each other at the same defined distance.

This known device suffers from the disadvantage of calling for guide rails which have to be constructed with cam tracks as well as rising and falling ramps. Moreover, resilient chain tensioning means must be provided for each conveyor chain because the chain path length is increased in the course of its movement when the lifting elements move via the rising ramps on to the cam tracks and again slide off the cam tracks via the falling ramps.

The prior art also discloses a system (U.S. Patent Specification 3 104 004) in which a circulating chain is provided which is inclined at an angle to the horizontal and in which drivers are secured on one chain member, one behind the other, the vertical extent of which said drivers increases from the front to the rear in the direction of movement so that all drivers project simultaneously above the plane of the conveyor to lift an article.

The construction and installation of these known systems is very complex owing to the drivers of varying size required for such a system. Moreover, the known system is unsuitable for transferring between two conveyors which are disposed parallel with each other because the transfer system itself can deposit an article on to a second conveyor extending transversely to the transfer direction only by the use of great force, once such an article has been lifted, because in this case the group of drivers must first be withdrawn from beneath the article which is retained by a stop abutment while the article itself is raised.

The prior art also discloses a system (German Offenlegungsschrift 2 515 024) in which the lifting elements are hinged to the conveyor chains in the form of pivoting levers.

It is an object of the present invention to provide conveying apparatus having a transfer conveyor of the kind described hereinbefore, which incorporates simpler elements which can be produced with less complexity and can be more readily installed and dismantled than in the case of known systems of this kind.

It is another object of the invention to provide conveying apparatus having a transfer conveyor of the kind described which can ensure trouble-free changeover of the transfer conveyor between positions ensuring transfer and positions allowing pass-through of articles which follow each other, on the conveyor from which the goods may be transferred optionally by the transfer conveyor, more particularly in the case of parallel conveyors and with a low energy consumption during the transfer motion itself but with a higher degree of reliability.

According to the present invention, there is provided conveying apparatus having mutually side-by-side conveyors and having transfer means for transferring an article from one conveyor to the other and *vice versa*, the trans-

ferring means comprising first and second endless flexible members trained around respective guide means so that the members define runs disposed clear of and generally parallel with the conveying planes of the conveyors, each member carrying lifting elements which when the lifting elements are carried along said runs project through the conveying planes for transferring an article thereacross, the runs being disposed in mutually overlapping arrangement so that they extend as seen in plan respectively from mutually transversely spaced points on one conveyor to corresponding points on the other conveyor, and drive means operable to drive the members synchronously, the lifting elements being disposed on the members so that during operation of the transfer means at least two of the lifting elements arrive at respective ones of said points on one conveyor simultaneously for lifting and transferring an article from that one conveyor to the other conveyor.

Special cam tracks with rising and falling ramps as well as resilient chain tensioning devices which must be provided in prior transfer conveyors can be omitted in apparatus according to the present invention while it is nevertheless possible to employ conveyor chain of conventional construction for said endless flexible members.

The lifting elements can be of very simple construction and need only be joined in non-rotational manner to the endless flexible members.

The endless flexible members may be chains or belts, such as toothed belts, in which case the lifting elements, possibly in the form of cams, can be rigidly joined to the belts or can be integrally produced with the belts either in the form of two small individual cams as well as in the form of a suitable short raised cam track with a rising ramp and a falling ramp. The use of belts with cam-like raised portions as well as rising ramps and falling ramps offers the special advantage that the articles are raised and lowered particularly smoothly, a feature which can be of significance particularly in the case of articles which are especially sensitive to shock.

Independently of the position of the lifting elements, the endless flexible members can remain tensioned constantly during the motion of such elements.

One embodiment of the invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a plan view of a transfer means disposed between two roller conveyors which extend parallel with each other;

Figure 2 is a sectional view along the line II-II of Figure 1 which shows an article which has arrived at the transfer means;

Figure 3 is a view similar to Figure 2 in which the transfer means with the raised article is illustrated in a position between the two parallel roller conveyors; and

Figure 4 is a view similar to Figure 2 in which the transfer means has deposited the article on the other parallel roller conveyor.

According to Figure 1 a transfer means or unit 10 is situated between two roller track conveyors 12 and 14 which are arranged parallel with and adjacent each other, and have their upper surfaces co-planar, and defining a conveying plane.

The transfer unit 10 comprises two pairs of endless flexible members in the form of conveyor chains 16, 18, or 20, 22, disposed parallel with each other, around respective endless paths in respective vertical planes parallel with each other. One pair of chains comprises a chain 16 and a chain 18 while the other pair comprises a chain 20 and a chain 22.

The path of each chain includes a straight top run which, as seen in plan, runs from a respective point on the roller conveyor 12 to a corresponding point on the roller conveyor 14 in the direction of the arrows R, and lower runs which return beneath the conveyors. Each chain is guided over two pulleys situated closely beneath the conveyor plane of the two roller conveyors, of which one is disposed at one point on the roller conveyor 12 and the other at the corresponding point on the roller conveyor 14, and each such chain is also guided over a driving pinion.

The top runs of all of the chains are parallel with each other, extending perpendicular to the conveying directions, indicated by arrows *r*, of the conveyors 12 and 14, the top runs lying in a common plane just below, and parallel with, said conveying plane. Further details of the transfer unit will be described by reference to the chain pairs 16, 18 because the other chain pair is constructed in like manner.

According to Figures 2 to 4, the chain 18 is provided with a guide means 24, which may be in the form of a sprocket or pulley, or if the chains are roller chains simply as a guide, at the point on the roller conveyor 12 which is distal from the roller conveyor 14 and is provided with a second guide means 26, which may take the same form as guide means 24, at the point in the roller conveyor 14 which is closest to the roller conveyor 12. The other chain 16 of the same pair of chains on the other hand is provided with a guide means 28, which may take the same form as the guide means 24 and 26, in the region of the roller conveyor 12 nearest to the roller conveyor 14 and is provided with a second guide means 30, which may also take the same form as the guide means 24, 26 and 28, in the region of the roller conveyor 14 which is distal from the roller conveyor 12. For convenience, the guide means 24, 26, 28 and 30 are referred to hereinafter as "pulleys". The distance between the pulleys 24 and 28 in the region of the roller conveyor 12 on the one hand and the pulleys 26 and 30 in the region of the roller conveyor 14 on the other hand is less than the width B of the articles 32 which are to

be conveyed and transferred.

Also, the lengths of the top runs of all of the chains, corresponding to the distance between pulleys 24 and 26 in the case of chain 18, and between the pulleys 28 and 30 in the case of chain 16, are all the same.

Furthermore, the chains are guided over driving pinions or sprockets 34 all of which are fixed on a common driving shaft 36 and are driven by a motor 38. The spacing between the pair of chains 16 and 18 and the pair of chains 20 and 22 is less than the length, measured in the direction, of motion of the roller conveyors 12 and 14, of the articles 32 to be conveyed.

At least one set of lifting elements 40 is provided, the lifting elements of the set being fixedly mounted on the four chains at the same location along each chain i.e. so that all the lifting elements 40 of the set are simultaneously guided around the respective pulleys in the course of the chain motion and therefore simultaneously project through the conveyor plane or are simultaneously guided clear of said plane, it being understood that the sprockets 34 engage the chains positively to drive the chains at identical linear speeds and without relative longitudinal motion, i.e. slippage, with respect to each other. Preferably the set of lifting elements includes a respective pair of elements 40 secured at the same place to each of the chains. In Figures 2 to 4 the elements 40 are shown slightly staggered for purposes of illustration.

A second set of lifting elements 42 can be provided comprising a respective further pair of elements 42 supported by each chain, each said further pair being situated at a distance from the pair of lifting elements 40 on the same chain, said distance being such that, in the course of movement of the chains, only one pair, either the pair of lifting elements 40 or the pair of lifting elements 42, projects above the conveying plane at any one time.

Each chain is guided over a slide rail 44 or 46 disposed parallel with the conveyor plane.

The transfer unit is in the pass-through position if the pairs of lifting elements are disposed completely beneath the conveyor plane. The transfer unit moves into the transfer position at the moment at which one of the two pairs of lifting elements 40 or 42 of all chains is moved about the associated pulleys 24 or 28 into the conveyor plane and rises above said plane. In Figure 2 the transfer unit is still in the pass-through position and in Figure 4 it is again in the pass-through position while in Figure 3 it is in the transfer position. If the transfer unit is not set in motion in the view illustrated in Figures 2 and 4 the item of piece goods 32 passes through on the roller conveyor 12 or on the roller conveyor 14 without being influenced by the transfer unit.

A transfer operation will now be described by reference to the drawing.

According to Figure 1 an article 32 moves to the roller conveyor 12 in the direction of the arrow *r* towards the transfer unit while another article 32 already moves on the roller conveyor 14 away from the transfer unit, also in the direction of the arrow *r*. According to Figure 2 the article 32 has arrived on the roller conveyor 12 at the transfer unit. If the chains 16 and 18 are then set in motion the pair of lifting elements 40 of the chain 16 simultaneously with the pair of lifting elements 40 on the chain 18 will act beneath the article 32 which is raised slightly above the conveyor plane and is moved by the chains in the direction of the arrow R towards the other roller conveyor 14 in accordance with the view illustrated in Figure 3. According to Figure 4 the article 32 has arrived at the parallel second roller conveyor 14 and both pairs of lifting elements have moved away beneath the article 32 thus lowering the article 32 in the direction of the arrows *f* on to the rollers of the roller conveyor 14. A guide rail 48 ensures that the articles 32 are retained on the rollers of the roller conveyor after the transfer motion.

A second pair of lifting elements 42 enables articles which arrive on the one roller conveyor to be transferred to the other with less interruption.

The direction of rotation of the transfer unit can be readily reversed in order to transfer articles from the roller conveyor 14 to the roller conveyor 12.

If the articles are to pass through on the roller conveyors in the region of the transfer unit the latter is stopped in a position in which the pairs of lifting elements 40 and 42 are disposed completely beneath the conveyor plane. Such stopping can be achieved in a simple manner, for example by means of limit switches.

The chains described and illustrated by reference to the exemplified embodiment can of course also be replaced by belts. It is then possible to attach the lifting elements fixedly on such belts or to produce them integrally with the belts in the form of a suitable short cam track with a rising ramp and a falling ramp.

Particularly smooth raising and lowering of the articles is possible if the lifting elements are provided with a rising ramp and a falling ramp.

WHAT WE CLAIM IS:—

1. Conveying apparatus having mutually side-by-side conveyors and having transfer means for transferring an article from one conveyor to the other and *vice versa*, the transferring means comprising first and second endless flexible members trained around respective guide means so that the members define runs disposed clear of and generally parallel with the conveying planes of the conveyors, each member carrying lifting elements which when the lifting elements are carried along said runs project through the conveying planes for transferring an article thereacross, the runs being disposed in mutually overlapping arrangement so that they extend as seen in plan respectively from mutually transversely spaced points on one conveyor to corresponding points on the

other conveyor, and drive means operable to drive the members synchronously, the lifting elements being disposed on the members so that during operation of the transfer means at least two of the lifting elements arrive at respective ones of said points on one conveyor simultaneously for lifting and transferring an article from that one conveyor to the other conveyor.

2. Conveying apparatus according to Claim 1, wherein said lifting elements are arranged in pairs on each said endless flexible member.

3. Conveying apparatus according to Claim 1 or 2, wherein the lifting elements are disposed on the endless flexible members in at least two groups such that while those of one group are being carried along said runs those of another group are clear of the said conveying planes.

4. Conveying apparatus according to any one of the preceding claims, wherein said drive means comprises drive pinions engaging the endless flexible members respectively, the drive pinions being arranged on a common axis.

5. Conveying apparatus according to any one of the preceding claims, wherein the endless flexible members slidingly engage support members extending along at least part of said runs.

6. Conveying apparatus according to any one of the preceding claims, wherein the lifting elements comprise cam surfaces adapted to promote smooth engagement and/or disengagement between the lifting elements and an article being transferred by the transfer means.

7. Conveying apparatus substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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1588287 COMPLETE SPECIFICATION
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Sheet 1

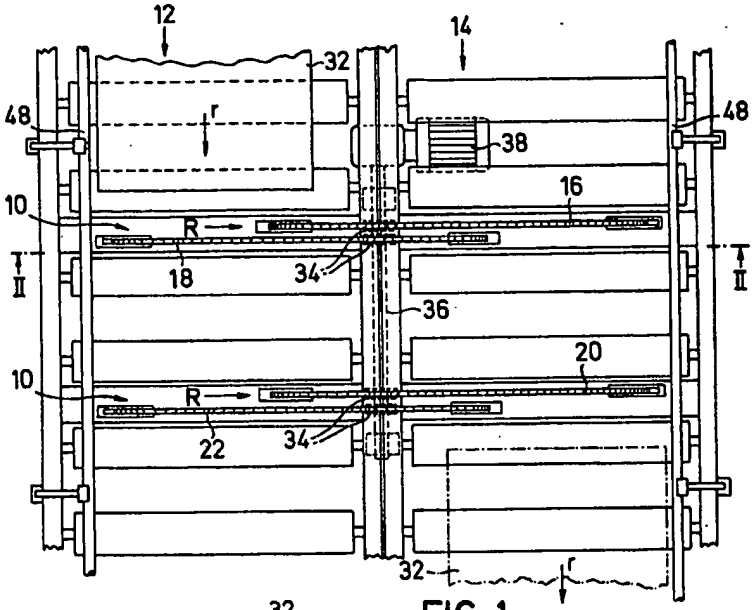

FIG. 1

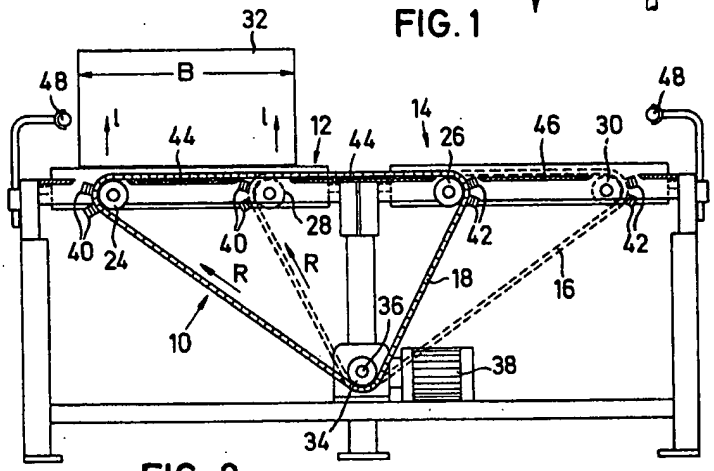

FIG. 2

1588287 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2

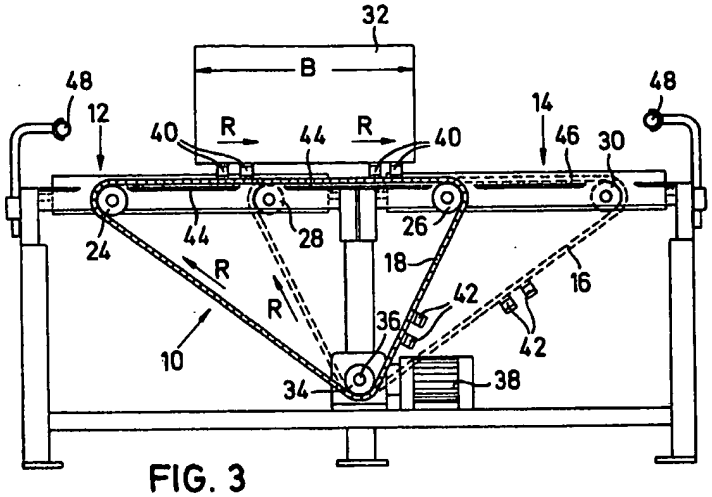

FIG. 3

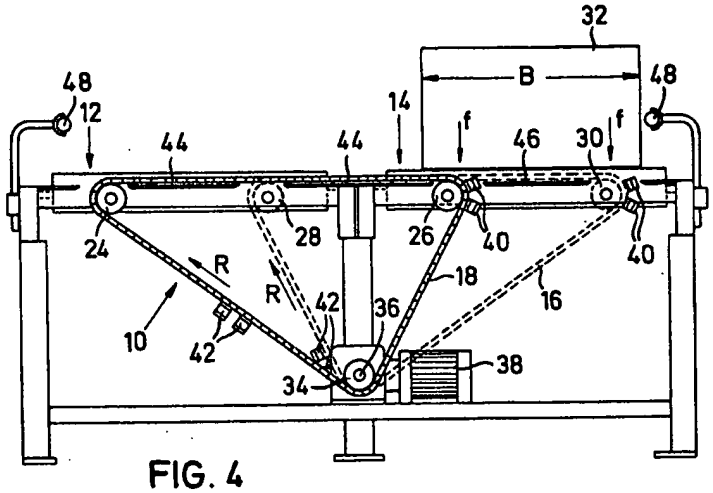

FIG. 4